

WHAT IS CLAIMED IS:

1 1. A composite magnetic head comprising:
2 a magnetoresistive head comprising:
3 a lower magnetic shield disposed on a substrate;
4 a lower gap layer;
5 a first ferromagnetic layer;
6 a non-magnetic layer;
7 a second ferromagnetic layer;
8 an anti-ferromagnetic layer having non-magnetic regions on both the ends thereof;
9 first electrode layers disposed respectively on the non-magnetic regions of the
10 anti-ferromagnetic layer;
11 magnetic domain control layers disposed respectively on the ends of a stack of
12 layers consisting of the lower magnetic shield, the lower gap layer, the first ferromagnetic layer,
13 the non-magnetic layer, the second ferromagnetic layer, the anti-ferromagnetic layer, and the
14 first electrode layers;
15 second electrode layers disposed respectively on the magnetic domain control
16 layers; and
17 an upper magnetic shield disposed on the second electrode layers and the stack of
18 layers by way of an upper gap layer; and
19 an inductive magnetic head disposed on the magnetoresistive head by way of an
20 insulation layer.

1 2. A composite magnetic head as defined in claim 1, wherein the non-magnetic
2 region of the anti-ferromagnetic layer is formed by implanting impurities into the anti-
3 ferromagnetic material.

1 3. A composite magnetic head as defined in claim 1, wherein a width of the first
2 electrode layer is 20 nm or less.

1 4. A composite magnetic head as defined in claim 1, wherein the first and the
2 second electrode layer contain one or more of elements of at least Au, Ta, W, Ru, Rh, Cu, Ti,
3 Ag, Pt, Pd, Cr, In, Ir, Nb and Zr.

1 5. A composite magnetic head as defined in claim 1, wherein a soft magnetic
2 layer is disposed between the domain control layer and the second electrode layer.

1 6. A composite magnetic head as defined in claim 1, wherein a crystal orientation
2 underlying layer is disposed below the magnetic domain control layer.

1 7. A composite magnetic head comprising:
2 a magnetoresistive head comprising:
3 a lower magnetic shield disposed on a substrate;
4 a lower gap layer;
5 a first ferromagnetic layer;
6 a non-magnetic layer;
7 a second ferromagnetic layer;
8 an anti-ferromagnetic layer having both ends whose width is narrower than that of
9 the second ferromagnetic layer;
10 first electrode layers disposed on the second ferromagnetic layer at both the ends
11 of the anti-ferromagnetic layer;
12 magnetic domain control layers disposed respectively on the ends of a stack of
13 layers consisting of the lower magnetic shield, the lower gap layer, the first ferromagnetic layer,
14 the non-magnetic layer, the second ferromagnetic layer, the anti-ferromagnetic layer, and the
15 first electrode layers;
16 second electrode layers disposed respectively on the magnetic domain control
17 layers; and
18 an upper magnetic shield disposed on the second electrode layers and the stack of
19 layers by way of an upper gap layer; and
20 an inductive magnetic head disposed on the magnetoresistive head by way of an
21 insulation layer.

1 8. A composite magnetic head as defined in claim 7, wherein a width of the first
2 electrode layer is 20 nm or less.

1 9. A composite magnetic head as defined in claim 7, wherein the first and the
2 second electrode layer contain one or more of elements of at least Au, Ta, W, Ru, Rh, Cu, Ti,
3 Ag, Pt, Pd, Cr, In, Ir, Nb and Zr.

1 10. A composite magnetic head as defined in claim 7, wherein a soft magnetic
2 layer is disposed between the domain control layer and the second electrode layer.

1 11. A composite magnetic head as defined in claim 7, wherein a crystal
2 orientation underlying layer is disposed below the magnetic domain control layer.

1 12. A composite magnetic head comprising:
2 a magnetoresistive head comprising:
3 a lower magnetic shield disposed on a substrate;
4 a lower gap layer;
5 a first ferromagnetic layer;
6 a non-magnetic layer;
7 a second ferromagnetic layer;
8 an anti-ferromagnetic layer disposed on a central portion other than both ends of
9 the second magnetic layer;
10 first electrode layers disposed respectively on both ends of the second
11 ferromagnetic layer;
12 magnetic domain control layers disposed respectively on the ends of a stack of
13 layers consisting of the lower magnetic shield, the lower gap layer, the first ferromagnetic layer,
14 the non-magnetic layer, the second ferromagnetic layer, the anti-ferromagnetic layer, and the
15 first electrode layers;
16 second electrode layers disposed respectively on the magnetic domain control
17 layers; and
18 an upper magnetic shield disposed on the second electrode layers and the stack of
19 layers by way of an upper gap layer; and
20 an inductive magnetic head disposed on the magnetoresistive head by way of an
21 insulation layer.

1 13. A composite magnetic head as defined in claim 12, wherein a width of the
2 first electrode layer is 20 nm or less.

1 14. A composite magnetic head as defined in claim 12, wherein the first and the
2 second electrode layer contain one or more of elements of at least Au, Ta, W, Ru, Rh, Cu, Ti,
3 Ag, Pt, Pd, Cr, In, Ir, Nb and Zr.

1 15. A composite magnetic head as defined in claim 12, wherein a soft magnetic
2 layer is disposed between the domain control layer and the second electrode layer.

1 16. A composite magnetic head as defined in claim 12, wherein a crystal
2 orientation underlying layer is disposed below the magnetic domain control layer.